THE FORMATION OF BILE PIGMENT FROM HAEMOGLOBIN IN TISSUE CULTURES *

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When red blood cells were added to living tissue cultures containing phagocytic cells from any tissue of mesodermal origin, the ingestion of the red cells and the gradual splitting of the haemoglobin into bile pigment and an iron-containing residue could be watched under the microscope. The bile pigment made its appearance within the living cells in the form of typical rhomboid or needle-shaped crystals of bilirubin (haematoidin), or as diffuse, bright green biliverdin. These intracellular pigments have the physical and chemical properties of bile pigment. After the ingestion of red cells there has also been observed within the phagocytic cell the formation of a pigment which does not give the Prussian blue reaction for iron and has not the characteristics of bile pigment. This pigment appears to be an intermediary stage in the transformation of haemoglobin into bile pigment. Another substance which is invisible in the unstained cell, but which becomes brilliantly blue when the reaction for iron is applied, has frequently been observed within the phagocytic cells by the side of the bile pigment.

Cultures of cells of ectodermal or endodermal origin remained indifferent to red blood cells, but the presence of phagocytic cells of mesodermal origin from any part of the body was almost invariably accompanied by the ingestion of the red cells and the intracellular conversion of their haemoglobin into bile pigment and an iron-containing residue. Tissue juices and dead tissues of different types (including dead connective-tissue phagocytes) were without effect upon red blood cells.

In a drop of blood incubated alone, the mononuclear cells of the blood often ingest the surrounding red cells and, as the haemoglobin of the ingested cells disappears, bile pigment and an iron-containing substance may appear within the mononuclear phagocyte.

It seems certain from the evidence accumulated so far that the ingestion of red blood cells by phagocytes of mesodermal origin can be followed by the conversion of the haemoglobin into bile pigment and an iron-containing residue within the body of the phagocytic cell. We have as yet obtained no evidence that cells of ectodermal or endodermal origin have this power.

These observations are contrary to the belief that haematoidin is never formed from phagocytized haemoglobin, and they support the view that the phagocytic reticulo-endothelial cells may be concerned in the transformation of haemoglobin into bile pigment. Whether the phagocytic cells liberate a ferment which is able to bring about this transformation extracellularly is not yet certain, but various experimental procedures are being applied to the solution of this problem.

* Abstract of experiments presented before the Johns Hopkins Research Society on May 28th, 1924. A more detailed report will appear later.